CLIMATIC SUBDIVISIONS OF THE UNITED STATES.[1]

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In dealing with the climatology of an area as large as that of the United States, we must, if our discussion be clear and systematic, adopt some scheme of subdivision into climatic districts, or provinces. Many suggestions have already been made along this line, and Mr. W. L. G. Joerg has recently done a useful piece of work in bringing together reproductions of the most important classifications of the "natural regions" or provinces of North America and of the United States.[2] Twenty-one different schemes are presented. Eight are grouped as *structural*, 4 as *climatic*, 2 as *vegetational*, 1 as *zoogeographic*, and 6 as *natural regions*. In addition, Mr. Joerg gives a new classification in which he has selected what seems to him best in the others.

Of the climatic classifications included by Mr. Joerg, those of Hult, de Martonne, and Köppen seem to the writer too detailed for general use. Supan's map is the most widely known.[3] * * *

The great variety of suggested subdivisions [of the United States], whether primarily physiographic, botanical, zoological, climatic, or "natural regions," is confusing if not discouraging. Moreover, there is no limit to the possible number of classifications, for these depend on any author's special interest or viewpoint, which may be climatic, or botanical, or physiographic, or one of administrative convenience. Even from the single viewpoint of climate alone, an almost infinite number of classifications might be proposed, for we may take as the basis of subdivision either the special conditions of one climatic element, or various combinations of two or more elements.

In working out a scheme of climatic subdivisions there seem to the writer to be a few essential considerations which should be kept in view. The classification must be simple. The separate divisions should, when possible, be bounded by large and easily recognized physical or political lines. Arbitrary limits, difficult to remember and to locate, should be avoided whenever possible. The scheme ought not to be too individual, but should commend itself to those who wish to use it on the ground of its being rational and practical. In any climate in which the cyclonic and anticyclonic control of weather types is a distinguishing characteristic, as it is in the belt of the prevailing westerlies, the climatic subdivisions should be determined with due regard to this control, for it is weather which, in the long run, gives a climate its character.[4] In other words the subdivisions should be chosen because of their special relations to cyclonic and anticyclonic tracks and movement; to local and characteristic weather distribution around lows and highs; to cyclonic and anticyclonic winds; and because of the general similarity of weather types over each province. Finally, the districts should, as far as possible, be the same as those which have been officially adopted in the publication of the meteorological and climatic data of the region. If, for example, the published data are grouped according to one scheme while the climatic subdivisions are based upon a different scheme, there is a great inconvenience in the use of these data. To take the specific case of the United States: There is no good and sufficient reason for using other boundaries, State lines, and the divisions adopted in the Weather Bureau's 106 "Climatological sections," are both convenient and practical.[5] Such a classification of climatic provinces makes it an easy matter to look up the special and detailed characteristics of each subdivision in the official publications of the Weather Bureau. The importance of this point will readily be appreciated by those who have endeavored to work out the climatology of some "climatic province" which did not coincide with any unit area adopted for purposes of publication of the official data.

In the United States there are three great natural topographic and climatic subdivisions. These are (1) the eastern, embracing about one-half of the whole area, extending east from the Rocky Mountains to the Atlantic and Gulf of Mexico; (2) the western mountain and plateau district; and (3) the narrow Pacific slope. Nowhere in the United States are sudden changes in climate to be met with in going from north to south, or vice versa. The transition is everywhere slow and gradual. The natural climatic subdivisions are, therefore, separated by meridional, not by latitudinal, lines. So far as east-west boundaries are necessary, these are therefore inevitably largely arbitrary.

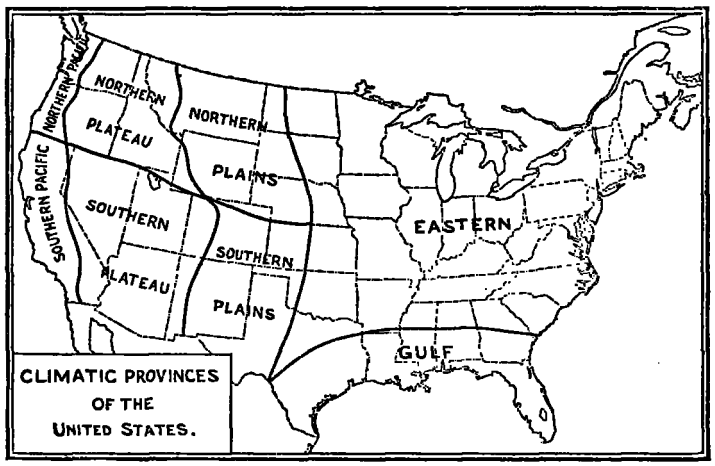

FIG. 1.—Climatic provinces of the United States. (R. DeC. Ward, 1915.)

Eastern province.—The first great eastern climatic district, enormous as is its extent, has nevertheless a certain remarkable uniformity in its weather types and its climate. It is freely open to the east, north, and south; to the Atlantic, to Canada, and to the Gulf of Mexico. Its seasons are strongly contrasted; its winter temperature gradients between north and south are unusually steep; its continental climate reaches to the Atlantic seacoast, with little modifying effect of the ocean waters; its rainfall is, as a whole, plentiful and well distributed throughout the year; its frequent and well-developed cyclones give it many rapid and marked weather changes and sharply contrasted types, controlled to a large extent by the diversity of temperature and of moisture conditions of the district from which the winds come. With the approach toward the Rocky Mountain

[1] *Condensed from* the Bull. of Am. Geog. Soc., September, 1915, 47: 672-680.

[2] *W. L. G. Joerg.* The Subdivision of North America into natural regions. Annals, Assoc. Amer. geogr., 1914, 4: 55-83.
Also gives reference to other classifications not especially considered in the article. It adds greatly to the convenience of the reader that one scale of map is used for all the North American classifications, and one scale for all those dealing with the United States.

[3] The classifications of Hult, Köppen, and Supan have been considered by *R. DeC. Ward*, The Classification of Climates, Bull., Amer. geogr. soc., 1906, 38: 401-412, 465-477. The maps of Supan and Köppen are also reproduced in the writer's Climate, considered especially in Relation to Man, 1908, Chap. III. Supan's map may also be found in Bartholomew's Atlas of Meteorology, 1899, pl. 1.

[4] This matter has been fully discussed by the writer in a recent paper "The weather elements in American climates," Annals, Assoc. Amer. geogr., 1914, 4: 3-54.

[5] In Prof. A. J. Henry's "Climatology of the United States" (Weather Bureau Bull. Q, 1906), the numerical data are all given by States.

area, on the west, there comes also a gradual transition to the drier, sunnier, and less cyclonically controlled climate of the Great Plains and eastern foothills. There is here no easily fixed and sharply determinable climatic boundary, although the lines of equal rainfall, cloudiness, and relative humidity all trend very generally north and south. The 100th meridian, the critical mean annual isohyetal line of 20 inches, and the 2,000-foot contour line, are all reasonably satisfactory. For our purpose we have selected the (generalized) line which follows the 2,000-foot contour. This agrees fairly closely with the 20-inch isohyetal line, and also with the 100th meridian, and marks the eastern margin of the physiographic unit of the Great Plains (fig. 1).

Gulf province.—To the south, over the States bordering on the Gulf of Mexico, the temperatures are higher; the winters are much milder; the cyclonic control is weaker; the temperature and weather changes are fewer and less emphatic; diurnal phenomena are more marked; conditions are more "settled"; the rainfall is heavier and usually has a marked summer maximum. Here, on these great warm, damp lowlands of the southern coastal plain we have the wealth of southern cotton and sugar cane and subtropical fruits. For these and other reasons this southern portion of our great eastern district may well be set apart as a subordinate climatic province. There is, however, no sharp climatic boundary of any kind which may be taken as the limit of this southern Gulf province. Hence an arbitrary line has been drawn, which includes on the south most of the Gulf coastal plain; is not far from the position of the mean annual (surface) isotherm of 65°F., marks in its central portion the northernmost position of the 100-foot contour line, and also accords with the dividing lines between four of the Weather Bureau's official "climatological sections" [as adopted in Bulletin W.].

Plains province.—The Plains climatic province in the proposed classification is included between the (generalized) line following the 2,000-foot contour and the (generalized) line of the main Rocky Mountain divide. The latter may be taken as a fairly satisfactory climatic boundary in relation to rainfall, cold waves, the direction and characteristics of the winds, and the prevailing weather types. The cyclonic control is less marked over the Plains than over the Eastern province, both because of the difference in relation to the storm tracks and because of the generally less emphatic development of the storms themselves. The climatic difference due to latitude and relation to cyclonic control are so considerable between the northern and southern Plains that a dividing line, which however marks no climatic boundary, may be drawn following in a general way the State lines between Wyoming, Nebraska, Colorado, and Kansas; and thus conveniently agrees with the subdivision adopted by the Weather Bureau.

Plateau province.—The Rocky Mountain divide on the east and the Sierra Nevada-Cascade divide on the west (both broadly generalized) are natural and convenient boundaries for the Plateau province. A great interior region of mountain ranges, high plateaus, and deserts, its chief characteristic is its small rainfall. It has the minimum cloudiness and the minimum relative humidity in the United States. Comparatively few cyclonic storms cross it. A persistence of winter high- and of summer low-pressure conditions characterizes it. The rain-shadow effect of its western mountain barrier necessitates irrigation undertakings, and where these are impracticable the aridity of the desert reigns supreme. Severe cold waves of the eastern type are barred out by the Rocky Mountain barrier. Diurnal, rather than cyclonic, phenomena prevail. Mountain climates, with their special peculiarities of strong sunshine, dry air, and large temperature ranges, are here found. An east-west line, roughly coinciding with the State boundaries of Oregon and Idaho on the north, and Nevada, Utah, and Colorado on the south, agrees in a general way with the southern boundary of the Columbia plateau, and also with boundaries of the Weather Bureau climatological sections. Hence, such a line may serve as a convenient division between the northern and southern Plateau provinces.

Pacific province.—The narrow coastal strip west of the Sierra Nevada-Cascades is the Pacific province with its great variety of climates, from rainy to arid, from those of the lowlands to those of the snow-covered mountain tops, from the cool summers of the coast to the great heat of the interior; with its prevailing mildness and equability, its subtropical rainy season and subtropical cyclonic controls, its great forests and its fertile agricultural valleys, its irrigated fruit orchards and its far-famed California health resorts. Between the rainier, cloudier, damper, and more changeable north, and drier and more settled south, the State line between California and Oregon is an easily determined and fairly satisfactory boundary. It does not differ greatly from the topographic divide between these States, and accords with the established scheme of subdivision adopted in the publication of the Weather Bureau climatic data.

For purposes of teaching the writer has found the scheme of climatic subdivisions here presented simple, useful, and satisfactory. The eight separate provinces are large enough to make possible further subdivisions to meet any special preferences or needs. The boundary lines are easily determined and easily remembered. And the provinces here adopted are such that the official Weather Bureau data, which are mostly subdivided on a State basis, may be easily fitted into the scheme.